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ABSTRACT

Karl Marx's theory of stages can be applied to computer use in the schools. The first stage, the P Stage, comprises the entry of the computer into the school. Computer use at this stage is personal and tends to center around one personality. Social studies teachers are seldom among this select few. The second stage of computer use, the D Stage, is characterized by the diffusion of computers into other areas of the school. The social studies teachers harbor great hopes at the D Stage. They expect computers to help students with the drill and memorization of the basic facts so they can proceed to the more important concepts. Disillusionment often accompanies the second half of the D Stage although computers do not whither away. In the T Stage the computer is seen and used chiefly as a tool, and is rarely considered as an end in itself or as an object to be studied. Jean Piaget posited stages of growth and concluded with Marx that students cannot go from stage one to stage three without moving through stage two. It may be possible for social studies teachers, however, to skip over the peculiarities of programming and the disappointment of drill-and-practice since social studies software for the T Stage is readily available from commercial publishers. A jump right into the T Stage may, in fact, be the best way for the social studies to enter the information age. (BZ)

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NEITHER MARX NOR PIAGET

by

James G. Lengel

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DEVELOPMENTAL STAGES IN SCHOOL COMPUTER USE:
Neither Marx Nor Piaget

James G. Lengel
Vermont Deputy Commissioner of Education
May, 1986

Karl Marx spent much of his life holed up in the British Museum in London, reading books. Without benefit of microfiche or database, he researched the growth and development of European societies during the seventeenth and eighteenth centuries.

From his observations and readings, he arrived at some conclusions, findings that haunt us even today. Societies, he said, progress through stages. They grow and change according to common patterns. Movement through these stages can be predicted, and no society can escape the violent shifts in power that accompany the shift from stage to stage. His theory of stages is quite useful, to some in understanding social change, and to others who desire to cause it. A theory of stages, whether true in all cases or not, is an interesting and valuable addition to our knowledge base.

We have not yet spent 30 years in a library studying how schools use computers. But we have discovered, like Marx, that there may be some common patterns in the ways that schools make use of these machines over time. Henry Becker at the Johns Hopkins Center for the Study of Technology in schools has gathered very interesting data from a sample of 1200 schools over

the last 5 years and we have sharpened our theories by close observations in Vermont schools and those in other places where we have worked. Marx' stages spanned centuries; ours span only the last half-dozen years since microcomputers made their dramatic appearance in our elementary and secondary schools. Marx was not happy with what we saw, and neither in some respects are we.

The P Stage

The first stage comprises the entry of the computer into the school, the first act, the prologue to the following two stages. This is the P stage, because above all else, computer use is personal at this stage--it centers around a single faculty member--the one, sometimes eccentric and most often male, who for whatever reason brings the computer into the building. During the first stage, computer use is built around this person. It is his students who use it. It is he, and often only he, who knows how to use the machine. It's used for what he is interested in and very little else.

What he is interested in is usually computer programming--typing instructions into the machine in BASIC or some other code to get it to do something. There is very little else to do with a computer in a school in these early days, due to lack of applications programs and the user-unfriendliness of the whole operation. Computers is a secret club in school in the P stage, destined for a self-selected few who are brave enough to master its arcane new world. Social studies teachers are seldom counted among this select few.

No one talks yet of computer literacy for the masses. Instructional software, especially in the social studies, is thin and unknown. Applications packages, like word processors and databases and spreadsheets are just being developed.

But programming grows during the P stage. The school buys more computers for Mr. P. More students take the programming course. The school introduces "logo" in kindergarten so the little kids can program just like the big ones. Mr. P's room turns into a computer lab. The School Board is impressed with the hum of activity that seems to be high-tech and perhaps even revolutionary. Hackers of the world unite. The P stage sets the schools on a road to computerization, an undiscovered country from whose bourne no school has yet returned.

The social studies classroom in most schools is hardly affected at the P stage. The secrets of computing remain in the mathematics and computer science department, for the most part. But a few social studies teachers find solace in this stage, as the following examples illustrate:

- students in the school computer science class produce a series of computerized graphic maps and charts on the history, geography, and economy of their home state, as an exercise to practice their programming skills. Social studies classes spend a day a month in the computer lab working with these programs as a supplement to their state history course. The maps and graphics are crude, and the content is thin, but the novelty of computers and the fact that their fellows designed the programs allows them to contribute to the curriculum.

- a social studies teacher in a middle school in Massachusetts learns to program in BASIC and purchases an early microcomputer for his use at home. Over more than two years, he develops his programming skills by designing a computer-managed simulation of Columbus' discovery of America. His students try it out along the way, and he finds that their learning and social skills are remarkably enhanced.
- the high school computer club designs a "quiz maker" for the teachers in the district, and contracts to computerize teachers' quizzes and tests for a small fee. The quiz maker can test a student's knowledge on the computer screen, provide instant feedback, and print out selected questions that can be duplicated as a written test. Though limited to simple multiple-choice questions, several social studies teachers make use of this service.

With a little exposure to the instructional use of computers, the school faculty begins to grumble. They are not content to let Mr. P alone have benefit of this new resource in the school. It is not fair, they say, to let only a few students onto the mystery of computers. They've heard and read that computers can help in all subjects: they can teach reasoning; they can help students learn the capitals of the states; they can provide an individual tutor for each learning-disabled student; and, they can motivate the slowest achievers to learn what they need to learn, especially in the informative-rich field of the social studies.

And so the dialectic begins. Mr. P the thesis, the rest of the school the antithesis.

The D Stage

And so the school moves inexorably into the second stage of computer use--the D stage. Foremost here is the diffusion of the computers into other areas of the school, and the end of Mr. P's personal electronic fiefdom. We see at this stage "computer literacy for all": courses and units that teach all students what the parts of a computer are and what is the difference between a bit and a byte and a floppy disk. Everybody--even the social studies department--learns how to turn it on, to run a program, and even program a little in BASIC or Logo. Computers are the coming thing, and the school takes on the responsibility to train all of its young people--not just those in the programming course--to be aware of its magic and its mysteries. The federal government helps during this D stage by spending $300,000 to define computer literacy. Social Education publishes an entire issue devoted to computing in the social studies; an NCSS "How To" pamphlet is developed on this topic. Luminous literati from throughout the land are called upon to lead us to the light of a new literacy.

Computing is for all at this second stage. The school buys hordes of instructional programs, many sight-unseen, in all the subject areas, including the social studies. Nationally, the data show that educational computer software sales skyrocket during this stage, most of it is of the drill and practice type. As the computer lab is invaded by non-hackers, including social

studies teachers, the amount of time spent in programming levels off. As the assistant principals and staff committees begin to manage computer and software purchases, the personal touch of Mr. P is lost. The computers now belong to the school, not to him. The new assistant superintendent becomes proud of his record in diffusing computers throughout the school; the school board is pleased as students announce to their parents, "I used a computer at school today. I was only on it for three and a half minutes, but I'll have another chance week after next. . .". The school has taken computers to its heart, spent lots of money on them and their instructional software, and entertains enormous expectations as to their potential for revolutionizing education.

The social studies harbors great hopes at the D stage. Teachers expect computers to help students with the drill and memorization of the basic facts so that they can get on to more important concepts. They purchase software that promises to provide a real-life simulation of a favorite historical event. Difficult skills, such as map-reading and higher-level reasoning, are thought to be especially prone to development via computer. The rising expectations of the D stage are exemplified in many schools:

- the social studies department allocates half its materials budget to computer software, purchasing hundreds of drill and simulation programs from various mail-order houses. The teachers have time and facilities to preview only a small portion of what they buy.

- once a week, the school's computer lab seems like a video arcade, as the social studies classes are scheduled to use the 20 computers. Students are drawn to the game-like software that teaches the dryest of facts in the most entertaining fashion, with fast-moving graphics, color, and sound effects. The capitals, the presidents, the Constitution, the trail of westward expansion, all are enjoyed without having to insert coins into the slot.

- once a year, the eighth grade social studies teacher brings GEOGRAPHY SEARCH into her classroom. With a single computer, borrowed from the lab, the students form four teams, each of which charts a schooner across an unknown ocean with only the stars of the night sky and the sun's shadow as guides. They learn about navigation, longitude and latitude, Western history, and the nature of discovery. (This program is the same one designed by the Massachusetts social studies teacher, now published and distributed nation-wide.)

- Every other Tuesday, all 11th grade social studies classes are interrupted for a computer literacy lesson in the lab. Here the students are run through a course which teaches them bits and bytes, how to hold a floppy disk, and how to program the computer in BASIC. The social studies teacher watches and wonders at this intrusion of computer literacy.

But within the glories of this D stage lurk the seeds of its own demise. The high expectations are not realized. The drill software finds its way back to the shelf after one or two uses. Kids are bored after two weeks of computer literacy--it gets them nowhere, into neither computers nor literature. The subject area teachers, especially in the social studies, find the instructional software at odds with their curriculum and overly focused on low-level skills. Dust begins to gather on the diffused computers. Diffusion results in disillusionment. Slowly the machines find their way back into the computer lab, available again for teaching programming. Mr. P now has all those computers available to his computer science course and his hackers' club. The data show a rise in the use of computers for programming at this stage, and a concomitant drop in the instructional-drill use of computers. The educational software market suddenly levels out--you don't need to buy many disks to teach BASIC. Programming is, for a few, very challenging mentally, and might also have a vocational application for some students. It is for them much more educational and rewarding than drill was for all the others.

Meanwhile, during stage two, along with the cartload of software that the school purchased from the publishers was slipped in almost unnoticed a word processor, perhaps a crude database program, and maybe a spreadsheet. A few teachers find these and discover that they are useful as tools in teaching and as help with many of the administrative duties that teachers are heir to. Someone in the school begins to process her words using

the computer. Another uses a database in a social studies course. One of the hackers shows the librarian how to connect over the telephone wires to CompuServe and then to the Dialog databases. These businesslike applications programs grow slowly during this stage, but in the background, and not to such an extent that they overcome the general disillusionment with computers that characterizes the second half of the D stage.

If we were to walk into a school at this point, we'd see the machines being used, again, primarily for teaching and practicing programming. We'd see lots of instructional software on the shelves, and we'd sense a disappointed attitude on the part of much of the social studies faculty.

The T Stage

But the computers do not wither away because of this disillusionment. The drill-instructional use of computers drops off, but not to zero, because for some skills for some students it proves to be useful. We're now in the third stage of computer use, a stage that few schools have reached. Only those few schools that have used computers actively for several years are now well into this stage. The letter for this stage is T, which stands for tool. It is the tool, or application programs whose growth predominates at this stage. Word processors are used to teach writing in the English class. Social studies students build databases on history and economic trends. The science lab is festooned with various analog measurement instruments connected to computers. A spreadsheet does the accounting for the school store, and foreign language students participate in an

interactive conversational simulation in the new language. Telecommunications increases as well during this T stage, as on-line services, directories, and databases become more available, cheaper, and easier to use. The AP news wire appears in the current events class. Students access Dialog databases from the school library. The science teacher converses regularly over the wire with his colleagues from around the country.

In the T stage, the computer is seen and used chiefly as a tool: an instrument that helps the faculty accomplish something. The computer is hardly ever considered as an end in itself or as an object to be studied, as it was in stages one and two. No longer a curiosity, the computer takes its place alongside the encyclopedia and the globe as a day-to-day instrument for teaching, used to enhance and assist in the accomplishment of traditional educational goals.

Students still learn programming during this stage, but not all students, and not as the major use of computers in the school. Schools and students realize that the world will not need all that many computer programmers, and that one no longer needs to write code in order to make use of a computer. Programming is taught to a minority of students, who for vocational purposes or simply to exercise their intellectual and logical faculties desire to elect the computer programming course.

But the computer is not simply a convenient tool at this stage. It is rather a tool that's tailored to the school's curriculum. The database is used in social studies, not for the purpose of teaching how databases work, but to illustrate and analyze certain historical concepts that have been part of the curriculum for 200 years. As we prepare to celebrate the 200th birthday of the Constitution, for instance, you will see the development of a Constitution data base, indexing the relevant articles, amendments, statutes, concepts and court cases. We tailor the computer to fit the curriculum at this stage, rather than vice versa as in the previous stages. The proletarian curriculum, which has been with us all along, has finally put the capital-intensive computer in its place.

At the third stage, the computer is doing what it does best--managing information. And which of our traditional school subjects handle the most information, data, and facts? Not math. Not computer science. Social studies handles the most information. It is our subjects then that holds the most promise for help from computerization. During stage three, the social studies use the computer to assist teacher and student to manage and analyze and draw conclusions from information.

Some examples from the T stage:

- the students in the Law class use a commercial database program to enter the 100 most important US Supreme Court cases of the last 200 years. They can now recall and analyze the cases by topic, by amendment, by location, by year, or by legal principle. This student-designed database will be used in future years as a regular part of the school's law course.
- the social studies department and the school library split the cost of subscriptions to CompuServe and Dialog, two dial-up information services. A computer in the library is dedicated to the purpose of using these services. Students can be found conducting searches in Dialog for information for term papers, getting the latest news from the AP videotext wire, or contacting students in another school across the country to exchange a political science data base that they have put together.
- Junior-high social studies students' research papers have taken on a new look with the coming of computers. Their bibliographies often include electronic sources among the citations; they often include tables drawn directly from spreadsheets that the students have built; pie graphs and bar graphs drawn by computer are interspersed with the text; and the words themselves have been processed into an attractive and readable document.

- the school library houses a collection of specialized computer databases for the social studies, some developed by teachers and students, and a growing number distributed by traditional social studies publishers. Geography, history, government, and economic databases are most common. They are published on floppy disk, ready to be used with standard database programs that the school already owns. The school looks forward to being a test-site for the Constitution Database, to be published by a consortium of hardware and software companies in 1987, that will include textual, visual, and numerical information on the Constitution.

Epilogue

Jean Piaget studied children even longer than Karl Marx studied societies. He posited stages of growth as well. Piaget concluded with Marx that you can't go from stage one to stage three without moving through stage two. One must work through the conflicts and revolutions of the early stage--they are necessary preparations for the higher-level accomplishments of the later stages. Does it follow, then, that a school must muddle through the P stage and then experience the disillusionment of the D stage, before it can expect to use the computer as a tool?

Few schools will have the option of jumping directly into the T stage. Most have experienced at least some of the joy and trauma of the earlier stages of computer use. But for many social studies teachers, it may be possible to skip over the peculiarities of programming and the disappointment of drill-and-practice. The software for social studies to use in the T stage is readily available from a variety of commercial publishers. Many of our students already know how to use databases, spreadsheets, and word-processors, and are just waiting to fill them with information from their social studies classes. In fact, a jump right into the T stage may be the best way for the social studies to enter the information age. The kinds of applications prevalent in this stage are more in line with the traditional goals of the social studies -- allowing students to draw conclusions from raw data, to test their own hypotheses with up-to-date information, and to present their ideas in graphically effective ways. As the costs of hardware continue to fall, and the availability of tool-type software rises, the social studies should be able to preempt the theories of Marx and Piaget by leaping directly to the third stage of computer use.

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